I CLAIM:

1.   A discrete event simulation (DES) for the operations and support (O&S) problem of a weapons system, comprising:

a plurality of dynamic objects having attributes that represent characteristics of weapons, said attributes having local values that define a local state of each dynamic object;

a plurality of static objects having data that is global with respect to the dynamic objects and functional operators, at least some of which are probabilistic;

a network of said static objects that are organized in accordance with a service use profile (SUP) to calculate a time-based prediction of weapons availability over a life cycle of the weapons system, said network having a global state; and

a simulation engine that advances to the next change of said local or global states whereat said static objects read and write said attributes in accordance with their functional operators and global data and update the time-based prediction of weapons availability as the dynamic objects traverse the network.

2.   The DES of claim 1, wherein said attributes include a plurality selected from Birth Date, TTF variate, Duty Cycle, Warranty Cycle, Down Time, MTBF, BitDetectable, GodsEye and Weapon Variant common attributes.

3.   The DES of claim 2, wherein at least some of said common attributes have a plurality of local values determined by environment or time.

4.   The DES of claim 1, wherein the simulation calculates a time-based prediction of operational and stockpile weapons availability.

5.   The DES of claim 1, wherein the simulation calculates a time-based prediction of warranted and not warranted maintenance activities.

6.   The DES of claim 1, wherein the network also calculates a time-based prediction

of spare parts stock.

7.   The DES of claim 1, wherein the static objects comprise a plurality of primitive blocks and a plurality of common blocks that are organized in accordance with the SUP, each common block comprising a plurality of primitive blocks and/or other embedded common blocks configured to process the dynamic objects and global data to route the dynamic objects, modify the dynamic objects or perform a statistical or informational calculation for a defined block function to support the calculation of the time-based predictions.

8.   The DES of claim 7, wherein for each said common block the plurality of primitive blocks and/or other common blocks have a different defined topology and a different defined instruction set.

9.   The DES of claim 7, wherein the common block has an interface for specifying parameters associated with the logical function of the common block in relation to the SUP.

10.   The DES of claim 7, wherein the plurality of common blocks include BIT, Stockpile Availability, Observe A_0, Operational Availability, Warranty Check, Set Failure Variates, Service Life Check and Parts Spares.

11.   The DES of claim 10, wherein the Stockpile Availability block calculates a measure A_s of the percentage of weapons in a stockpile that are ready for issue (RFI) as $A_s = RFI / (Nd - Att)$ where Nd is the numbered delivered to the stockpile up to a point in time and Att is the attrition up to a point in time.

12.   The DES of claim 11, wherein the measure A_s is a numbers-based running average.

13.   The DES of claim 10, wherein said dynamic object includes MTBF, Time-to-

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Failure (TTF) and BitDetectable attributes, said Set Failure Variates block using the MTBF as an input to randomly generate a value for the TTF attribute and randomly generating either a 0 or 1 for the BitDetectable attributes based on an overall test effectiveness probability.

14. The DES of claim 13, wherein said Set Failure Variates block reads a plurality of MTBF attributes of one dynamic object for different environments to calculate a plurality of TTF attributes of one dynamic object for the different environments.

15. The DES of claim 14, wherein the MTBFs increase as the weapons system matures but decrease as individual weapons age.

16. The DES of claim 10, wherein said dynamic objects includes Birth Date, MTBF and TTF attributes, said Service Life Check block using the Birth Data and CurrentTime attributes to calculate the age of the dynamic object and compare it to a service life, and if the age is greater than the service life either take the dynamic object out of service or recalculate its MTBF and TTF attributes as a function of its age.

17. The DES of claim 16, wherein the MTBF and TTF attributes increase as the weapons system matures but decrease as individual weapons age.

18. The DES of claim 10, wherein said dynamic objects include Birth Date and Down Time attributes, said Observe A_o block calculating a single point estimate A_os of A_o as $A_os = 1 - $ Down Time / (CurrentTime $-$ Birth Date) where CurrentTime is a current time and a count of the number of observations to date.

19. The DES of claim 18, wherein the Operational Availability block calculates a running average A_0 from a plurality of single-point estimates A_0s observed at different points in the network weighted by a cumulative number of observations for each estimate.

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20.   The DES of claim 10, wherein said dynamic objects include time-to-failure (TTF), Duty Cycle and BitDetectable attributes, said BIT block performing a sequence of logical operations on the dynamic object to determine whether a false alarm failure occurs, whether a failure is detectable by the value of the BitDetectable attribute and whether the dynamic object's Duty Cycle is greater or less than its TTF.

21.   The DES of claim 20, wherein the BIT block generates one of the following outputs: (1) Un-failed dynamic object that has passed BIT, (2) Failed dynamic object that has passed BIT, (3) Un-failed dynamic object that has failed BIT; and (4) Un-failed dynamic object that has passed BIT, but has an undetectable defect.

22.   The DES of claim 20, wherein said TTF and Duty Cycle attributes have a plurality of values for different environments.

23.   The DES of claim 10, wherein said dynamic objects include Warranty Cycle attributes that accumulates time or cycles, said Warranty Check block checking the Warranty Cycle attribute against a warranty threshold for a failed dynamic object and indicating the failed dynamic object as warranted or not warranted.

24.   The DES of claim 23, wherein said warranty threshold and said Warranty Cycle attribute have a plurality of values for different environments.

25.   The DES of claim 10, wherein said dynamic objects have a plurality of failure modes that require different parts spares, said Parts Spares block calculating a time delay for a failed dynamic object by calculating a random fault isolation delay, calculating the maximum replenishment delay for the multiple failure modes and calculating a random removal and replacement delay.

26.   The DES of claim 25, wherein dynamic objects resident to said Parts Spares Block represent rotable pools of available spare parts and which, when decremented, become unavailable as a spare to said dynamic objects entering the Parts Spares Block,

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requiring a time delay to be made available.

27. The DES of claim 26, wherein said entering dynamic objects may experience delay due to unavailability of said resident dynamic objects, where delayed dynamic objects are held in a queue primitive providing delay time information.

28. The DES of claim 26, wherein said resident dynamic objects are held in a resource primitive block when available to provide utilization information.

29. The DES of claim 26, wherein a plurality of resident dynamic objects represent a plurality of failure modes for said dynamic objects entering Parts Spares Block

30. The DES of claim 10, wherein the network comprises at least one sub-model to calculate the time-based predictions, said sub-model comprising a plurality of common blocks having a relational topology and instruction set to perform a common function.

31. The DES of claim 30, wherein said dynamic objects include Duty Cycle, TTF Variate and BitDetectable attributes, a Test Effectiveness sub-model comprises a BIT block that checks the BitDetectable attribute and compares the Duty Cycle to the TTF attribute to determine whether a dynamic object has failed and, if so, a Set Failure
5   Variates block resets the TTF, BitDetectable, and DutyCycle attributes.

32. The DES of claim 10, where said dynamic objects include Birth Date and Down Time attributes, an Operational Availability sub-model comprising a plurality of Observe A_o blocks at different points in the network, each block calculating a single point estimate $A_o s$ of A_o as $A_o s = 1 - $ Down Time $/ ($ CurrentTime $-$ Birth Date$)$ where
5   CurrentTime is a current time and recording a number of observations to date, and an Operational Availability block that calculates a running average A_o from the plurality of single-point estimates A_o s weighted by the cumulative number of observations for each estimate.

33.   The DES of claim 10, where said dynamic objects include MTBF and TTF attributes, a reliability growth and degradation sub-model comprising a Delivery primitive block that initializes the MTBF attribute, a Set Failure Variates block that randomly generates a TTF attribute and a plurality of Service Life Check blocks throughout the network that compare the age of the dynamic objects to the TTF attribute to pass or fail the dynamic object.

34.   The DES of claim 10, wherein said dynamic objects include TTF/CTF, Duty Cycle, and Warranty Cycle attributes, said Predict Repair Maintenance sub-model comprising a Set Failure Variates block that initializes the TTF/CTF attribute, a BIT block that tests the accumulated Duty Cycle against the TTF/CTF attribute to pass or fail the dynamic object, and a Warranty Check block that compares the Duty Cycle to the Warranty cycle to determine whether the failed dynamic object is warranted or not-warranted.

35.   The DES of claim 1, wherein the SUP describes a logical structure of delivery, maintenance, deployment and testing policy and infrastructure and logistics constraints.

36.   A discrete event simulation (DES) for the operations and support (O&S) problem of a weapons system, comprising:

    a plurality of dynamic objects having Birth Date, Time-to-Failure (TTF) variate, Duty Cycle, Warranty Cycle, Down Time, MTBF, BitDetectable, GodsEye and Weapon Variant common attributes that represent characteristics of a weapon, said attributes having local values that define a local state of each dynamic object;

    a plurality of static objects including primitive blocks and common blocks having data that is global with respect to the dynamic objects and functional operators, at least some of which are probabilistic, each common block comprising a plurality of primitive blocks and/or other embedded common blocks configured to process the dynamic objects and global data to route the dynamic objects, modify the dynamic objects or perform a statistical or informational calculation for a defined block function selected from BIT, Stockpile Availability, Observe A_0, Operational Availability, Warranty Check, Set

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Failure Variates, Service Life Check and Parts Spares;

15   a network of said primitive and common blocks that are organized in accordance with a service use profile (SUP) that describes a logical structure of delivery, maintenance, deployment and testing policy and infrastructure and logistics constraints to calculate a time-based prediction of stockpile and operational weapons availability, maintenance activities, and spare parts stock over a life cycle of the weapons system, said

20   network having a global state;

        a simulation engine that advances to the next change of said local or global states whereat said primitive and common blocks read and write said attributes in accordance with their functional operators and global data and said network updates the time-based predictions as the dynamic objects traverse the network.

37.   The DES of claim 36, wherein the MTBF attribute has a plurality of values for different environments.

38.   The DES of claim 36, wherein the value of MTBF attribute increases as the weapons system matures but decrease as individual weapons age.

39.   The DES of claim 36, wherein the Stockpile Availability block calculates a measure A_s of the percentage of weapons in a stockpile that are ready for issue (RFI) as $A_s = RFI / (Nd - Att)$ where Nd is the numbered delivered to the stockpile up to a point in time and Att is the attrition up to a point in time.

40.   The DES of claim 36, wherein said dynamic object includes MTBF, Time-to-Failure (TTF) and BitDetectable attributes, said Set Failure Variates block using the MTBF as an input to randomly generate a value for the TTF attribute and randomly generating either a 0 or 1 for the BitDetectable attributes based on an overall test

5   effectiveness probability.

41.   The DES of claim 36, wherein said dynamic objects includes Birth Date, MTBF and TTF attributes, said Service Life Check block using the Birth Data and CurrentTime

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attributes to calculate the age of the dynamic object and compare it to a service life, and
if the age is greater than the service life either take the dynamic object out of service or
5   recalculate its MTBF and TTF attributes as a function of its age.

42.   The DES of claim 36, wherein said dynamic objects include Birth Date and Down
Time attributes, said Observe A_o block calculating a single point estimate A_0s of A_o as
$A_0s = 1 -$ Down Time / (CurrentTime $-$ Birth Date) where CurrentTime is a current time
and a count of the number of observations to date.

43.   The DES of claim 36, wherein said dynamic objects include time-to-failure
(TTF), Duty Cycle and BitDetectable attributes, said BIT block performing a sequence of
logical operations on the dynamic object to determine whether a false alarm failure
occurs, whether a failure is detectable by the value of the BitDetectable attribute and
5   whether the dynamic object's Duty Cycle is greater or less than its TTF.

44.   The DES of claim 36, wherein said dynamic objects have a plurality of failure
modes that require different parts spares, said Parts Spares block calculating a time delay
for a failed dynamic object by calculating a random fault isolation delay, calculating the
maximum replenishment delay for the multiple failure modes and calculating a random
5   removal and replacement delay.

45.   A method of analyzing an operations and support (O&S) problem of a weapons
system, comprising:
        creating a model of the O&S problem based on a service use profile (SUP) that
describes a logical structure of delivery, maintenance, deployment and testing policy and
5   infrastructure and logistics constraints;
        translating the model into a discrete even simulation in which dynamic objects
flow through a network of static objects that are organized in accordance with the model,
said dynamic objects having common attributes with local values and said static objects
having data that is global with respect to the dynamic objects and functional operators at
10   least some of which are probabilistic; and

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executing the discrete event simulation by advancing to a next state whereat said static objects read and write said common attributes in accordance with their functional operators and global data and said simulation updates a time-based prediction of weapons availability over a life cycle of the weapons system.

46. The method of claim 45, wherein said common attributes include a plurality selected from Birth Date, Time-to-Failure (TTF) variate, Duty Cycle, Warranty Cycle, Down Time, MTBF, BitDetectable, GodsEye and Weapon Variant common attributes.

47. The method of claim 46, wherein the MTBF attribute has a plurality of values for different environments.

48. The method of claim 46, wherein the value of MTBF attribute increases as the weapons system matures but decrease as individual weapons age.

49. The method of claim 45, wherein the static objects comprise a plurality of primitive blocks and a plurality of common blocks, each common block comprising a plurality of primitive blocks and/or other embedded common blocks configured to process the dynamic objects and global data to route the dynamic objects, modify the dynamic objects or perform a statistical or informational calculation for a defined block function to support the calculation of the time-based prediction.

50. The method of claim 49, wherein the plurality of common blocks include BIT, Stockpile Availability, Observe A_0, Operational Availability, Warranty Check, Set Failure Variates, Service Life Check and Parts Spares.

51. A discrete event simulation (DES) for the operations and support (O&S) problem of a Exoatmospheric Kill Vehicles (EKV) program, comprising:

a plurality of dynamic objects having attributes that represent characteristics of EKVS, said attributes having local values that define a local state of each dynamic object;

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a plurality of static objects having data that is global with respect to the dynamic objects and functional operators, at least some of which are probabilistic;

a network of said static objects that are organized in three hierarchical blocks Delivery, Repair & Deployment; Silo Storage and Periodic Test; and Maintenance

10 Returns in accordance with a service use profile (SUP) to calculate a time-based prediction of weapons availability over a life cycle of the EKV program to (1) decide between two competing maintenance concepts A and B for the program; (2) quantify repairs of EKV payloads; and (3) identify major spares requirements for EKV payloads return, said network having a global state; and

15 a simulation engine that advances to the next change of said local or global states whereat said static objects read and write said attributes in accordance with their functional operators and global data and update the time-based prediction of weapons availability as the dynamic objects traverse the network.

52.   The DES of claim 51, wherein said common attributes include a plurality selected from Birth Date, Time-to-Failure (TTF) variate, Duty Cycle, Warranty Cycle, Down Time, MTBF, BitDetectable, GodsEye and Weapon Variant common attributes.

53.   The DES of claim 52, wherein the MTBF attribute has a plurality of values for different environments.

54.   The DES of claim 52, wherein the value of MTBF attribute increases as the weapons system matures but decrease as individual weapons age.

55.   The DES of claim 52, wherein the static objects comprise a plurality of primitive blocks and a plurality of common blocks, each common block comprising a plurality of primitive blocks and/or other embedded common blocks configured to process the dynamic objects and global data to route the dynamic objects, modify the dynamic

5 objects or perform a statistical or informational calculation for a defined block function to support the calculation of the time-based prediction.

56.   The DES of claim 55, wherein the plurality of common blocks include BIT, Stockpile Availability, Observe A_0, Operational Availability, Warranty Check, Set Failure Variates, Service Life Check and Parts Spares.